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PUBLIC HEALTH REPORTS

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INFECTIOUS JAUNDICE.

The issue of the Public Health Reports of February 12 contained a report from Dr. L. J. Richards regarding an outbreak of infectious jaundice at Elizabeth, N. J.

Since then Dr. Youngman, health officer of Williamsport, Pa., has reported that during November and December, 1914, there were in Williamsport probably a hundred or more cases of this disease.

Dr. Edge has also reported that there was an outbreak in Stevens County, Ga., beginning last November.

CONTROL OF MALARIA.

OILING AS AN ANTIMOSQUITO MEASURE.

By J. A. A. LE PRINCE, Sanitary Engineer United States Public Health Service

Oiling of water surfaces as an antimalaria measure should be supplementary to proper drainage. When funds are not available for drainage, mosquito propagation can be largely controlled by oiling.

The object to be attained in using petroleum or other oils is to destroy larvæ of mosquitoes. To attain this, the surface of the water must be completely and continuously covered with a film of oil.

The effects thus produced in preventing mosquito breeding are:

1. Where mosquito larvæ are present, such larvæ can not penetrate the oil film with their breathing tube, and so drown and die.
2. Mosquitoes do not lay eggs on the oiled surface of water.

The larvæ of the malaria-conveying species of mosquitoes rest and feed in a horizontal position at the water surface. They are more easily destroyed in nature by the application of oils or larvacide than are larvæ of most other mosquitoes.

Grades of Oil.

There are many grades of oil on the market that will serve for mosquito destruction, ranging from the very light oils such as kerosene, to the heavier oils, known as crude oil.

Kerosene or illuminating oil is useful but has disadvantages such as rapid evaporation, high cost, and possible waste due to the invisible oil film formed. It has three advantages: It forms a thin film; it spreads rapidly, and it is readily obtained in small or large quantities.

Examples of Control of Malaria by Oiling.

While the use of oil is supplementary to proper drainage, its relative importance is very great.

In the antimalaria campaign at Habana, Cuba, oiling was relied upon to supplement the drainage for mosquito control.

Oiling was largely used in maintaining the force of 50,000 men on the Isthmus of Panama sufficiently free from malaria to construct the canal.

Dr. Malcomb Watson, who has had extensive experience in malaria eradication and who directed the successful control of malaria in the Federated Malay States, after inspecting the methods of procedure at Panama reported to the Royal Colonial Institute as follows:

> I went there because I wanted to study the details of their methods, in particular how much of their excellent results were due to drainage, and how much to screening, oiling, and quinine. From my visit I concluded the results were mainly from oiling, which was done for practically half a mile on each side of the canal, or at least the inhabited portions of the zone. The great majority of the population do not live in screened houses and very few take quinine.

Intermediate grades of oil between the illuminating oils and heavier crude oils may be obtained. They are not as expensive as kerosene, and when applied they spread fairly rapidly, and give a visible oil film. They have been used extensively for mosquito control and have proved satisfactory.

The thicker oils of varying density and constituents, frequently referred to as crude oil, having a paraffin or asphalt base, are cheapest in their first cost. They do not spread as much nor as rapidly as the lighter oils and the heavier constituents are apt to gravitate to the bottom of the container and become too thick and heavy for use.

More of this grade of oil must be applied per unit of area to form a film on the surface of the water to be oiled. Since larger quantities would be required the cost of its transportation may be a determining factor in its selection.

Where crude oil is available at a low cost it may be treated and used to advantage, as will be described.

Larvacides, or substitutes for oil, should not be used, unless their practical value and the possible dangers that may result from their use are thoroughly understood. Such substances may be poisonous, less effective, and more costly for field work than oil.

The writer has obtained very satisfactory results at Panama by using a larvacide as a substitute for oil. It was used because the local problem consisted of controlling mosquito propagation in hot weather when showers occurred every day for several weeks. Extensive construction work made proper drainage impossible and oil applied to water surfaces was washed away before it killed mosquito larvæ. It then became necessary to use a substance which would mix with water and kill mosquito larvæ rapidly when they came into contact with it. Such a larvacide could be applied with success during time of rain and was so used. It consisted of a mixture of crude carbolic acid, resin, and caustic soda. In addition to being a satisfactory larvacide, it proved to be useful in destroying algæ (spirogyra), and was also a good disinfectant.

It was used to treat the thick oils so that they would spread more rapidly and give a more extensive and uniform film.

Crude oils, to which from 5 to 10 per cent of this larvacide was added, were used in knapsack sprayers. Owing to the poisonous properties of the larvacide it is advised that this product be used only under the direction of boards of health or health officers. Its constituents, method of manufacture, and application are fully described by S. T. Darling in the American Journal of Public Health for February, 1912. It is made as follows: One hundred and fifty gallons of crude carbolic acid containing not less than 15 per cent of phenols are heated in an iron tank having a steam coil with steam at 50 pounds pressure; 200 pounds of finely crushed and sifted common rosin are dissolved in the boiling acid, and then 30 pounds of caustic soda dissolved in 6 gallons of water are added. There is a mechanical stirring rod attached to the mixing tank. The product is ready in a few minutes, yielding about 3½ barrels. As a mosquito larvacide it is used by spraying an aqueous emulsion (one part of larvacide to five of water) over the surface to be treated and along the margin of pools and ponds or other mosquito-breeding places, so that the resulting dilution of the larvacide has a thin, milky opalescence representing approximately a dilution of 1 to 5,000. A 1 to 1,000 dilution kills the larvæ more rapidly, and was used for destruction of larvæ in overflowing pools, etc., and where the use of oil was not practicable.

Storage and Precautions Against Fire.

Laborers who use oil daily soon become careless and therefore certain precautions and regulations to guard against fire should be adopted. In purchasing oil for mosquito control a safe flash test oil (as 140° F. flash test) should be used if the oil is to be kept near any building. Whenever possible, oil should be stored in isolated buildings. A small shack made of galvanized-iron sheets is preferable and its location should be at a safe distance from other buildings.

Oil stored in unsafe containers, as wooden barrels or improperly covered tanks near railroad tracks, is very apt to catch fire. Small quantities are usually shipped in wooden barrels and if left exposed in the sun, leakage occurs and danger from fire is increased. Provision must be made for fire protection and precautions taken to avoid spilling on the ground at or near the place of storage. Sufficient sand or loose earth should be kept available close to where the oil is stored for use in extinguishing a flame. Oil-storage houses and faucets of storage tanks or barrels should be kept locked when not actually being used. No smoking is to be allowed near them.

Where Oiling is Applicable.

Oil may be applied to water surfaces of pools, ditches, streams, shallow lagoons, and edges of deep ponds, lakes, and rivers, when necessary. Large water containers that are not protected against the entrance of mosquitoes should be protected with oil. It is unnecessary and expensive to oil collections of water that may be more economically treated by filling or drainage.

Larvæ of mosquitoes do not occur in bodies of water of considerable depths, unless aquatic plants, algæ, or débris are present. They are to be found near the banks of such bodies of water.

Oil should not be applied in places where mosquito larvæ do not occur. It may be applied to moving water in ditches and streams. More oil is required when used in oiling ditches overgrown with vegetation, shallow ponds containing grass, etc., because such vegetation impedes the formation of a complete film.

It is not advisable to oil water when the film will not remain effective, as just before rainstorms. During rainy periods the value of oiling is decreased. The ability of larvæ of mosquitoes to live under an oil film for an hour should be considered. Oil films will not penetrate a barrier of grass in water or move around similar obstructions. When such obstructions to the oil film occur on the water surface and are not removed, sufficient oil must be used to cover both the obstructions and the spaces between them. Wind will break up an oil film and transport all oil to one shore of the body of water.

In moving water, obstructions such as sticks, stones, brush, roots, and algæ, will sometimes interfere with the uniform spread of the oil film due to the division of surface currents.

Shallow bodies of water containing much grass may be too low to drain, as well as difficult and expensive to oil properly. They may in some cases be treated by either filling or ditching and collecting the water into a small area which will then be more easily oiled.

Methods of Application.

Water surfaces may be oiled by using:

1. A garden watering pot.
2. Knapsack sprayer.

3. A spraying apparatus in a small flat-bottom boat.
4. A drip can or drip barrel for intermittent or continuous oiling.
5. A small bundle of cotton waste soaked in oil.

It is not practicable to state how much oil should be used per unit of area. The density and spreading qualities of different shipments of commercial oils, and even of oil from the top and bottom of the same barrel, may vary so much as to upset all calculations. All oils spread better in warm weather. Just sufficient oil should be used to form a complete film. Laborers sometimes have difficulty in seeing where a film of kerosene is present on water, but can soon be so trained in the use of the other oils as not to apply more oil than is necessary.

(1) The watering pot is useful for limited areas, small pools, and where it is easy to get close to all parts of the propagation area. Relatively thick oil can be so applied.

(2) The knapsack sprayer with adjustable nozzle is useful for all purposes. It will spray the lighter oils and distribute in a satisfactory manner the heavy commercial crude oils that have been treated with phenol compounds. By its use oil may be placed wherever desired from 1 to 20 feet from the operator. This machine holds five gallons and rests on the shoulders and back of the operator. He pumps with one hand and directs the oil stream or spray with the other. While traveling over rough ground and not operating the pump the laborer has both hands free. With this apparatus the work is less tiring than using a watering pot. No oil is spilled or wasted by too rapid application. The knapsack sprayer was extensively used in the antimalaria campaign at Panama and found to give excellent results as to proper distribution of oil and as a preventive against wasting oil. In using the treated heavier oils, spraying machines with adjustable nozzles do not really give an oil spray of particles of liquid as small as is used in the application of insecticides. Such fineness is not essential. The oil is so distributed that its subsequent spread soon takes place and that is all that is desired.

(3) Spraying machines with hand pumps are used in small, flat-bottom boats for oiling parts of lagoons, lakes, bayous, edges of stagnant rivers, etc., near settlements, where such bodies of water can not be more economically controlled by drainage, or cleaning and fish control.

(4) The use of "oil drips" for intermittent or continuous application on ditches or streams containing moving water has proved satisfactory. Where the heavy oils are used the drip can is placed 3 to 4 feet above the water surface so that the drops of oil strike the moving water with a blow and at once change into a thin oil film. The stand, base, or object that supports the drip can must be secure and beyond

danger of removal by flood waters. Cans of from 5 to 30 gallons' capacity are used for dripping. The drip outlet is placed several inches from the bottom to allow of the settling of the heavier constituents of the oil that might clog up the outlet. The oil being warm in the daytime flows more freely than at night. The object of dripping a stream is to allow a sufficient number of drops of oil to fall on the moving water surface to form a continuous thin film. The water in ditches or streams so treated and kept fairly well cleaned or free from obstructions will convey the oil to all parts of the stream below the drip can and it will keep a film of oil on the places of minimum or zero current. It is in this quiet water that most mosquito larvæ are apt to occur.

On ditches and streams having an average width of water surface of 1 foot, from 10 to 20 drops of oil per minute are applied. The quantity of oil required depends upon the spread of oil, the alignment of the stream, roughness of banks, grade, obstructions, etc. For economic control a trial should be made at each ditch or stream where a drip can is used to determine the desired rate of flow. The drip can should be regulated accordingly. In many cases the drip need be operated continuously for only one or two days of each week. With larger streams it may be found necessary to operate the drip continuously day and night. On long streams or ditches it is at times necessary to use several drip cans. They are then so located that the next drip can is installed approximately at the point where the effect of the drip at the source disappears. Continuous dry weather may make it become necessary to discontinue the use of some drips or to change their location. At such season, pools will be left isolated at the sides of a stream and will have to be filled, or separately treated with oil by other methods. When the stream stops running the use of drips is discontinued and any water left in the stream bed is oiled with a knapsack sprayer or watering pot. With the best care oil drips will clog, due to suspended solids or heavy constituents in the oil, and must be adjusted as often as necessary, The disadvantage of oil drip cans is that they will not give satisfactory service without proper attention, may become clogged, or be washed away by floods. Their use is generally more effective and economical than the direct application of oil by sprinkler or knapsack sprayer for water in motion. A thinner, but satisfactory, film of oil is obtained from the heavier cheap oils. Several types of drip cans are described below and shown in the illustrations. (See figs. 1 to 5.)

A crude but cheap and easily made drip can consists of a 5-gallon can such as is used for shipping illuminating oil. A hole is made in its bottom with a 2 or 3 inch round nail. A wad of loose cotton is wrapped around the nail just below its head. The nail is then pushed through the hole on the inside of the can, and crude oil is put in the can, which is suspended or placed on a stand over the ditch. By pulling the point of the nail downwards and gently pushing it upward the flow of oil may be decreased or increased as desired. (See Fig. 1.)

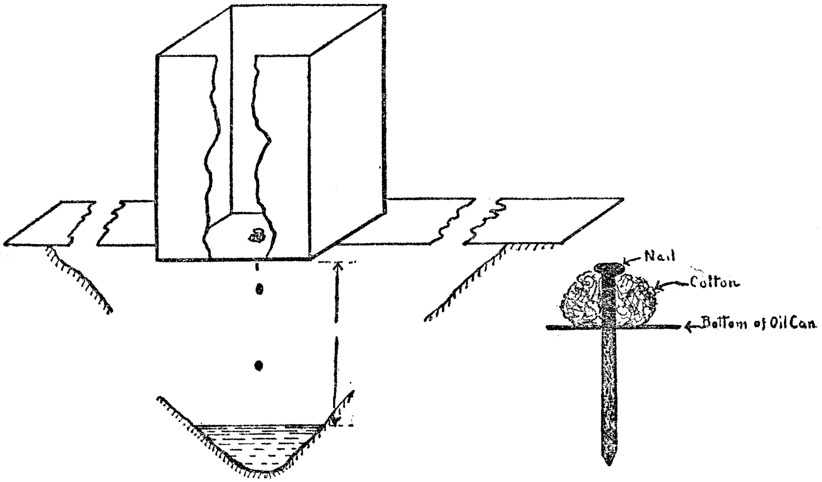

FIG. 1.—Oil drip made by inserting nail in bottom of container.

For thinner oils the 5-gallon oil can with metal discharge tap may be used and the tap adjusted to give within a few drops of the number desired to be discharged per minute (see Fig. 2). When oils less fluid than kerosene are used the spout or discharge point should be 1 or more inches above the bottom of the container, in order to prevent clogging of the very small escape outlet used.

A heavy crude oil of asphalt base was extensively used by the writer at Panama for mosquito control. It was cheap, but became thick when not exposed to the sun. It was what is termed "run of pipe" and contained thick constituents. When allowed to remain at rest a heavy thick oil more like grease than oil would collect at the bottom of the container. Different shipments would vary in density. This oil was often treated with about 5 per cent of the larvacide above mentioned, well mixed, and then used in drip cans. The drip used is shown in the illustration. (See Figs. 3 and 4.) It consists of a piece of thin metal similar to that part of a flat-wick kerosene-oil lamp burner which holds the lamp wick. It is made so that the flat wick fits loosely into it and is attached in a horizontal position to the outside of the can 2 or 3 inches above the base, in order to allow a space for the heavier oil constituents to settle. A lamp wick is inserted into this opening and water placed in the lower 2 inches of the container. Oil is then poured into the drip can. By com-

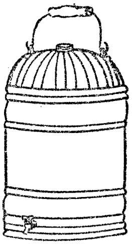

FIG. 2.—Oil can used to drip light oils.

pressing the wick holder the flow of oil is reduced and by widening it the flow is increased. The colored laborers soon became expert in adjusting the oil flow and were able to operate the drips to within a few drops per minute of the amount ordered for use on any particular drip can. Each can was numbered and records were kept of amounts of oil used in refilling. Thirty-gallon drip cans were frequently used.

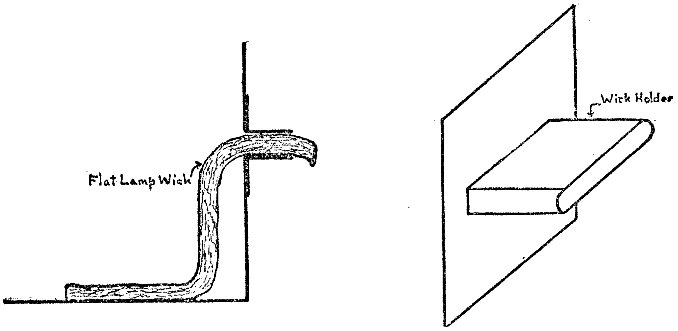

FIG. 3.—Detail of drip used for heavy oils.

Other devices may be invented and used to advantage for dripping different grades of oil, the density of which may vary daily. The main objects to be attained are to keep the rate of flow fairly constant with varying temperatures to prevent clogging of the outlet, to make use of containers that are available, and not to use an apparatus that can easily be rendered useless by incompetent labor.

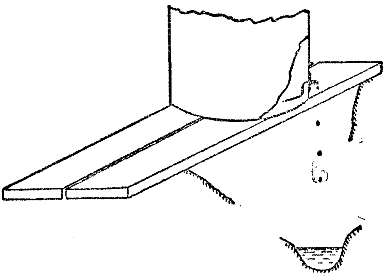

FIG. 4.—Oil drip for heavy oils.

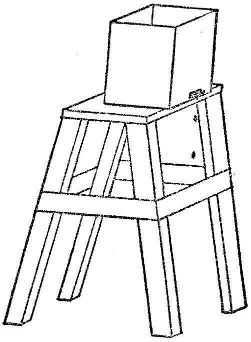

FIG. 5.—Oil drip can support.

(5) Where the quantity of moving water is too small to warrant the use of a drip can, as in ditches that are becoming dry, in limited seepage water outcrops, slow-running springs, etc., a small bundle of oil-soaked cotton waste is placed at the source of the water. It gives off a thin film of oil continuously for about a week. This waste,

after serving its purpose, is resoaked in oil and used again. The heavier oils are useful for this method of oiling.

Personnel.

In all mosquito-control work it is economy to select intelligent laborers who take an interest in the work, and to pay them a higher wage as they become skilled. The extra pay is saved many times over in results and saving of materials as compared with the work of untrained labor. The man who notes at a glance whether oil drips he sees are working properly and goes out of his way to remove an obstruction in a stream because he knows it may save extensive regrading, and attends to other apparently trivial but important details, is worth two ordinary laborers. Incompetent laborers are apt to increase operating expenses and are careless about using oil properly. The work to be done may be scattered over a relatively large area, and the inspector can not watch the men closely. His work is of such a character that he must often leave his laborers and devote his time to inspection.

Inspections.

The success of the work will depend very largely on the ability and personal interest taken in the work by the inspector or foreman in charge of the oiling and the oiling squad. Where oiling is being done for a community, there must be one reliable and active person held responsible for the efficiency of the field work. He must go to all possible production areas at frequent intervals and see and know that the work is being satisfactorily performed, that no known places are missed, that no mosquito larvæ reach the pupal stage of development, and that places needing attention are promptly attended to. A knowledge of the local conditions of topography and possibilities of water being retained in any locality during unusually wet seasons is essential. When the pools, ditches, and stream beds become dry, they must be reinspected after showers, as some of them may retain water in pools and need attention. This frequently happens in out of the way places. The inspector must never assume that everything is in satisfactory condition, but must go and see and be certain of it.

Working Maps and Records.

It is advisable wherever possible to have, or make, a map of the district showing the location of all streams, ditches, pools and other possible mosquito-production areas. Each breeding place may be denoted by a letter or number, and the inspector's daily report or daybook will show the work done and oil used at each place. If the extent of the breeding place is recorded so much the better. The data thus obtained will show the cost of treatment or maintenance of any ditch or other breeding place. Oil drip cans should be numbered and record kept of dates of filling and amounts supplied. The entries, or system of recording, should be made as simple as possible. It is very discouraging to a man anxious to get at the field work and not fitted for clerical work to be held back by such causes. The object of the records are:

(1) For the health officer or other person to whom the inspector reports to know what is going on and to be able to make intelligent inspections.

(2) In case there is a change of inspectors, if costs of work are increased or decreased the fact may be at once noted.

(3) No known breeding places can be accidentally neglected.

(4) The high unit-cost of oiling any one pond, ditch or stream will indicate the advisability of using other methods of control.

An excellent example of the results which may be obtained in our Southern States by the intelligent application of oiling as an antimalaria measure is the work accomplished under the direction of Dr. T. W. M. Long during the Anopheles propagation season of 1914, at Roanoke Rapids, N. C.

The settlement is a mill town. In 1913 malaria was rife and people were leaving town on that account. The mills could not get sufficient labor. Senior Surg. H. R. Carter and Surg. R. H. von Ezdorf, United States Public Health Service, inspected the existing conditions in 1913 and made appropriate recommendations. The mill owners wisely subscribed $3,600 to carry out the proposed measures. The 6½ miles of streams and ditches were controlled by oil during 1914. Three thousand gallons of oil were used from May 20 to November 1, 1914, costing about $300. The oil was used to supplement the drainage. Very few cases of malaria existed at Roanoke Rapids in 1914 and the change is so satisfactory to the mill owners that they propose to continue the oiling as a means of malaria control in the future.

The writer desires to acknowledge the suggestions and assistance received from Surg. R. H. von Ezdorf during the preparation of this paper.

HYPOCHLORITE TREATMENT OF WATER SUPPLIES.

PORTABLE PLANT AND FIELD EQUIPMENT FOR ITS ADMINISTRATION

By H. A. Whittaker, Assistant Director, Division of Sanitation, Minnesota State Board of Health.

In 1910 the Minnesota State Board of Health constructed portable emergency hypochlorite plants (*a*) to be kept in readiness for immediate transportation to localities within the State where water supplies were suspected or known to be contaminated. These plants